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Secondary antireflux surgery

A. Abdel-Raouf El-Geidie*, N. Gadel-Hak, O. Fathi

Mansoura Gastroenterology Surgical Center, Mansoura University, Jehan St., 35516 Mansoura, Egypt

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ABSTRACT

Background & aim: With the introduction of laparoscopy, the number of antireflux surgeries (ARS), and consequently failed fundoplications, had increased. We report the mechanisms of fundoplication failure after ARS, and present our experience in surgical correction of failure.

Methods: Twenty nine patients who had failed fundoplication were reoperated. Pre- and postoperative evaluation of patients included symptom severity score, endoscopy, barium study, esophageal motility and pH metry.

Results: The initial procedures were Nissen in 16, Toupet in 10, and Nissen–Rossetti in 3 patients. The causes of failure were transdiaphragmatic migration of fundoplication ($n=7$), disrupted fundoplication ($n=7$), tight fundoplication ($n=4$), slipped fundoplication ($n=3$), paraesophageal herniation ($n=3$), tight crural repair ($n=3$), and migration with disruption ($n=2$). The secondary ARS performed were Nissen ($n=16$), Toupet ($n=9$), paraesophageal hernia repair with crural repair ($n=2$), widening of crural repair ($n=1$), and taking down fundoplication ($n=1$). Per- ($n=4$) and postoperative ($n=5$) complications were minor with no mortality. At Follow-up, symptoms were significantly improved.

Conclusion: Reoperations for failed ARS may be performed safely with excellent results. Proper patient selection and paying attention to some technical details at initial ARS could safe the patient another surgery.

1. Introduction

Laparoscopic Nissen fundoplication was first introduced in 1991[1] and it is now an established surgical treatment of severe reflux disease.[2–4] Data from all over the world have demonstrated a three- to five fold increase in the number of fundoplications performed for gastroesophageal reflux disorder (GERD) over the last decade.[4] Failure rate of open fundoplication was 9–30%[5–7] and for laparoscopic one 2–17%,[8–12] depending on the definition of failure and the duration of follow-up.

Failures may occur because of anatomic reasons or misdiagnosis of the underlying problem. When symptoms recur after surgery, patients may choose to be treated medically or with reoperation. In the past, laparotomy or thoracotomy was used to surgically correct recurrent symptoms.[4,13–24] Laparoscopic antireflux reoperation has been performed successfully after primary operative failure[13,25,26] and the results indicate that laparoscopic surgery results in a lower morbidity.[4]

The aim of this study was to determine the mechanism of symptomatic fundoplication failures after fundoplication (open or laparoscopic) for GERD or paraesophageal hernia. A second aim was to determine revision surgery is safe and effective.

2. Patients and methods

Between September 1998 and October 2007, 29 patients were referred to Gastroenterology Surgical Center, Mansoura University, Egypt for surgical treatment of a failed ARS. The initial operation was performed at our hospital in 25 patients (86%) and outside in 4 patients (14%). All patients underwent a laparotomy or laparoscopy as the initial procedure for the treatment of GERD ($n=20$) or paraesophageal hernia ($n=3$). No patient had prior thoracotomy or thoracoscopy. The previously performed operations are listed in Table 1. Nissen procedure consisted of a 360-degree fundoplication with sectioning of the short gastric vessels; Nissen–Rossetti operation consisted of a 360-degree fundoplication without sectioning of short gastric vessels. Toupet procedure was a 270-degree posterior fundoplication with or without dividing the short gastric vessels.

There were 24 (83%) male and 5 (17%) female patients. The mean age was 37.8 (21–60) years. Information about previous antireflux procedures done at our hospital was recorded prospectively on a computerized database. Data from the initial operation done

* Corresponding author. Tel.: +002 010 5290111; fax: +002 050 2214319.
E-mail address: ahmedraoaf@mans.edu.eg (A. Abdel-Raouf El-Geidie).

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Table 1
Type of primary antireflux surgery.

Operation	Patients No	%
Open Nissen	12	41.4
Open Toupet	8	27.6
Laparoscopic Nissen	4	13.8
Laparoscopic Nissen–Rossetti	3	10.3
Laparoscopic Toupet	2	6.9

outside our center could not be obtained from the surgical team, but the type of fundoplication could be easily identified at reoperation.

The indications for reoperation were mainly based on the analysis of a detailed clinical history, barium study, esophagogastroduodenoscopy, esophageal manometry, and 24-hour pH monitoring. Symptom severity (Table 2) and well-being scores (Table 3) were assessed before and after redo surgery. Manometric criteria for definition of an incompetent lower esophageal sphincter were a low resting pressure (<10 mmHg) and/or a short overall (<2 cm) or abdominal length (<1 cm). Manometric criteria indicating an esophageal body dysfunction were a low-amplitude peristalsis (<30 mmHg) and/or a greater than 30% incidence of abnormal waves. Abnormal esophageal acid exposure was defined by percentage of total reflux time and De Meester's score.[27]

Fundoplication revision was recommended when the preoperative evaluation revealed a surgically correctable anatomic or functional disorder that corresponded with the patient's symptoms. Patients in whom postoperative symptoms could be adequately managed conservatively without reoperation were excluded. The indications for surgical reoperation were persistent or recurrent GERD, severe dysphagia, or presence of paraesophageal hiatal hernia (Table 4). The decision to reoperate patients with persistent or recurrent GERD was based mainly on the presence of intolerable symptoms, absence of major risk factors, radiologic, endoscopic and pH monitoring findings, good response to proton pump inhibitors (PPIs), and patient's preference to be reoperated rather than to take PPIs. Patients with severe dysphagia were allowed at least 4 weeks before endoscopic pneumatic balloon dilatation, and if dysphagia persisted, reoperation was considered after at least 3 months.

The technique of secondary surgery was similar for both open and laparoscopic access except in the access. For laparoscopic access, the abdomen was entered using the Hasson or Veress needle techniques in the left upper quadrant. A 10-mm port is placed, and a camera is inserted. Blunt dissection is used to separate adhesions. The camera is switched to a second port after its placement 2–3 cm above the umbilicus in the midline. The remainders of the ports are placed under direct vision in the usual manner for a laparoscopic Nissen fundoplication.[1,3] In case of laparotomy, the abdomen is entered through an upper midline incision skirting the umbilicus. The procedure then continues, depending on the situation. Careful dissection of the hiatal region, upper segment of the stomach, and distal esophagus was the most crucial and difficult step of the reoperation. These structures and the fundoplication must be completely identified and isolated to establish the precise diagnosis of the problem and correct it. The type of secondary operation was determined by preoperative esophagogastric assessment and intraoperative findings.

Table 2
Symptom severity scale.

Symptom	Grade	Description
Heartburn	No	No
	Mild	Occasional episodes
	Moderate	Main reason for the medical visit
	Severe	Continuous interferes with daily activities
Chest pain	No	No
	Mild	Occasional episodes
	Moderate	Frequently present
	Severe	Interferes with daily activities
Dysphagia	No	No
	Mild	Occasional, short duration
	Moderate	Requires liquids to clean
	Severe	Episodes of bolus obstruction requiring medical attention

Table 3
Well-being score.

Grade	Description
Excellent	Completely recovered
Good	Major improvement with minor problems
Fair	Major improvement but still some significant symptoms or side effects
Poor	Minor or no improvement or even worsening

Transdiaphragmatic migration of fundoplication and paraesophageal hiatal hernia were managed by adequate esophageal mobilization and reduction of all herniated stomach followed by posterior crura repair. When the hiatus was still wide, one or two sutures were occasionally necessary in the anterior portion of the crura. No patient required prosthetic enforcement of a wide hiatus. If the fundoplication was disrupted or slipped/misplaced, the fundoplication was reconstructed. Reconstruction into either complete or partial wrapping was determined by the results of esophageal manometry (weak esophageal body peristalsis indicated a partial wrap). If the patient had significant gastroesophageal reflux, with intact fundoplication and no hiatal hernia, the fundoplication was refashioned from a 270-degree to a 360-degree valve. When a tight hiatus was the cause of the dysphagia, the hiatus was widened by either removing one or more crura repair sutures or dividing the crura. If the hiatus was not tight but the wrap appeared tight, the fundoplication was refashioned as a posterior partial fundoplication. Collis gastroplasty was not done for any patient even with apparently short esophagus, as extensive and adequate esophageal mobilization was found to be sufficient to return the gastroesophageal junction and 2 cm of distal esophagus to the abdomen without tension.

Open access was offered for all of first revisions but with increased experience in laparoscopy, laparoscopic access was tried in the late cases. Laparoscopic access was recommended only if the patient had initial operation by laparoscopy. The preoperative and postoperative symptomatic outcome and well-being scores were determined postoperatively by personal interview. Statistical analysis of the well-being score was performed using the Student *t* test.

3. Results

3.1. Mechanism of failure

The most common cause for persistent or recurrent GERD was herniation of the fundoplication and was detected in 9 (31%)

Table 4
The reason for failure of fundoplication ($n = 23$).

Cause of failure	Patients No	%
Persistent or recurrent GERD		
Transdiaphragmatic migration of fundoplication	7	24
Disruption of Fundoplication	7	24
Slipped/misplaced fundoplication	3	10
Migration and disruption of fundoplication	2	7
Patients with severe dysphagia		
Tight fundoplication	4	14
Tight crural repair	3	10
Patients with paraesophageal hernia		
Paraesophageal herniation	3	3

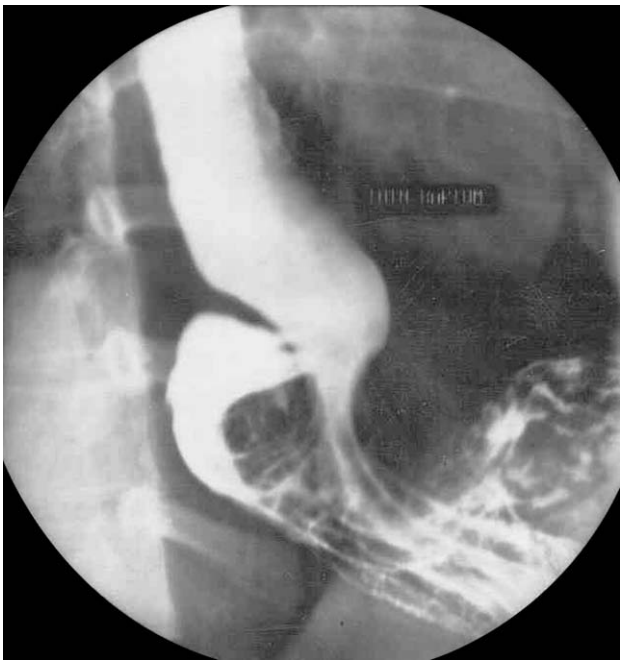

Fig. 1. Barium study showing a migrated up wrap. Note the compression on the esophagus by the migrated portion.

patients (Figs. 1 and 2) (Table 4). The fundoplication was intact in 7 (77.8%) of these patients and it was disrupted in two patients (22.2%). Disruption of fundoplication was the second most common cause for persistent or recurrent GERD. The disruption was complete in 4 patients (Fig. 3) and partial in the other three (Fig. 4). The main reason for severe dysphagia was tight fundoplication (Fig. 5) and/or tight crural repair.

3.2. Surgical details

The type of secondary antireflux surgery (SARS) is outlined in Table 5. SARS was performed and completed laparoscopically in

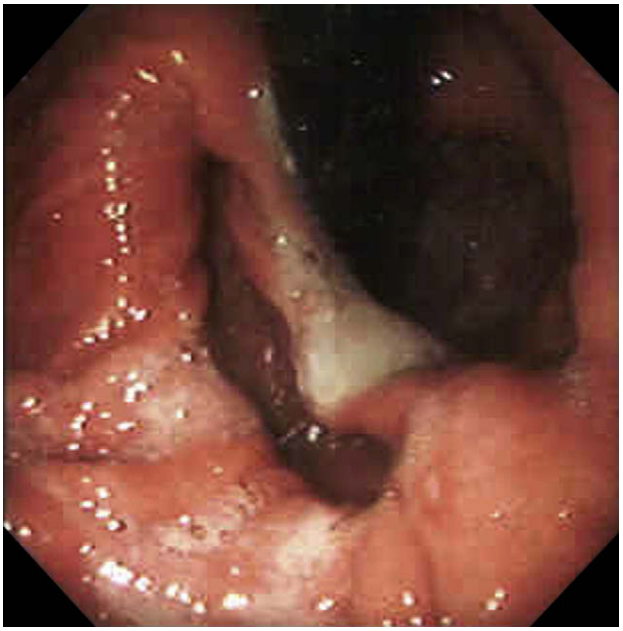

Fig. 2. Retroflexed endoscopic view showing a migrated wrap with big paraesophageal diverticulum.

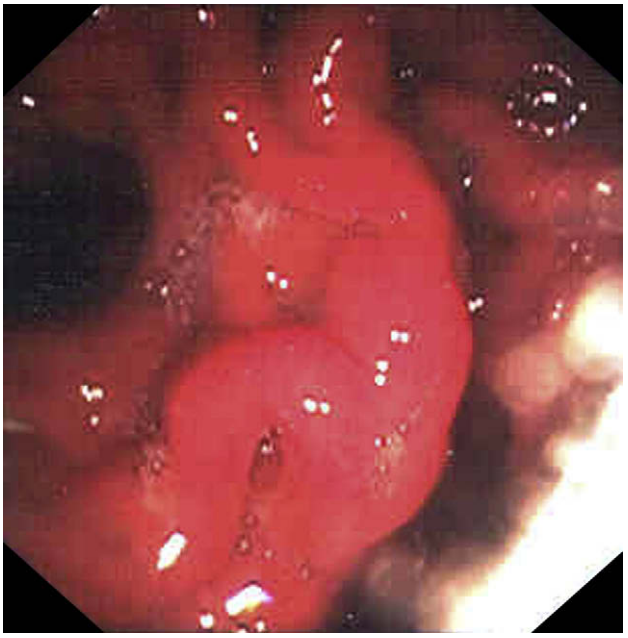

Fig. 3. Retroflexed endoscopic view showing a totally disrupted wrap.

two patients late in the series (Table 6). Another patient had a laparoscopic trial but converted to laparotomy. The main reason for conversion was impossibility to dissect the hiatal region safely owing to the presence of intense adhesions from previous operation. The average postoperative hospital stay was 4.9 days, with a range of 3–16 days. The two patients whose reoperation was completed laparoscopically stayed in hospital for 2 and 3 days. Operative time varied from 72 to 280 min, with an average of $132 + 39$ min. The intraoperative blood loss was not significant and no patient required blood transfusion.

3.3. Symptomatic outcome

Follow-up was possible for 23 (79%) patients at $28.2 + 11.8$ months (Fig. 6). The well-being score for all patients was $3.4 + 2.1$

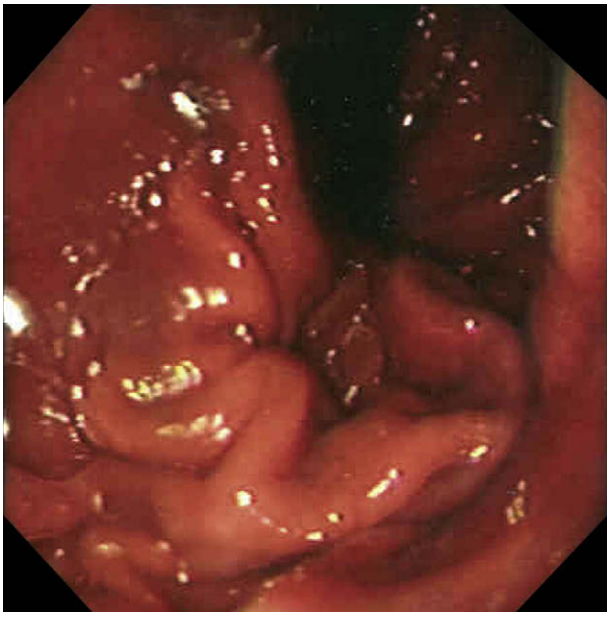

Fig. 4. Retroflexed endoscopic view showing a partially disrupted wrap.

Fig. 5. Barium study showing a tight wrap.

before and $1.3 + 2.4$ after surgery ($p < 0.001$). Of patients interviewed, 23 (79.3%) were satisfied with their decision to have a reoperation. Twenty patients (69%) reported good to excellent control of heartburn and regurgitation, with the remainder reporting fair or poor control. Two patients reported early occasional dysphagia, and one patient was still significantly bothered by dysphagia, for whom endoscopic dilatation was required.

3.4. Objective outcome

Radiologic and endoscopic assessment of the fundoplication after SARS had shown that only three patients had complicated fundoplication; one had transdiaphragmatic migration, one had a disrupted wrap, and last one had severe reflux despite an intact wrap. Results of esophageal manometry and 24-hour pH metry (done for 21 (72.4%) patients) are shown in Table 7.

3.5. Complications

There was no mortality. Four patients (17.4%) had intraoperative complications. Left pneumothorax was identified in one patient and was due to perforation of the left pleura behind the diaphragmatic crus during encircling of the esophagus. No treatment was necessary. One patient had bleeding due to persistent blood oozing from spleen during sectioning the short gastric vessels and the bleeding was controlled with careful use of cautery and sponge

Table 5
Type of secondary antireflux surgery.

	Patients No	%
Nissen fundoplication	16	55.2
Toupet fundoplication	9	31
Paraesophageal hiatal repair with crural repair	2	6.9
Crural widening	1	3.4
Taking down fundoplication	1	3.4

Table 6
Cases managed by laparoscopic redo surgery.

Total $n = 2$	Primary ARS	Indication of revision	Secondary ARS
Case 1	Laparoscopic Nissen fundoplication	Recurrent GERD symptoms due to partial wrap disruption and slipped wrap	Laparoscopic redo Nissen fundoplication
Case 2	Laparoscopic Nissen fundoplication	Dysphagia due to tight crural repair	Widening of the crural repair and conversion to partial fundoplication

compression without the need for blood transfusion or splenectomy. Gastric perforation occurred in two patients; one of them was detected intraoperatively and sutured in two layers. This patient had good outcome. The perforation was not detected intraoperatively in the other patient and he had a gastrocutaneous fistula that closed conservatively after 9 days.

Five patients (17.2%) had postoperative complications; wound infection ($n = 1$), incisional hernia ($n = 1$), transdiaphragmatic migration of fundoplication ($n = 1$), partially disrupted wrap ($n = 1$), and severe reflux ($n = 1$). The last three patients were treated medically without further surgery. Incisional hernia patient was treated by mesh repair.

Most patients complained of dysphagia, abdominal distention, and increased flatus after the procedure, but the symptoms were usually mild and temporary. Only one patient had one session of endoscopic pneumatic dilatation for relief of dysphagia.

4. Discussion

Failed antireflux operations are seen now more frequently than in the last decade.[28–30] This reflects the dramatic increase of the number of laparoscopic fundoplications. This mishap occurs in 5–10% of the patients[8,11,26] and may be due to incomplete preoperative evaluation, bad choice of the operation, technical errors, or poor patient selection.[23–26,31] Precise identification of the cause for failure of the primary antireflux procedure is essential for the correction of the problem.[31]

The main mechanisms of failure after antireflux procedures are herniated fundoplication, slipped or misplaced fundoplication, disrupted fundoplication, paraesophageal hernia, tight fundoplication, and tight hiatus.[9,35] Persistent or recurrent GERD and dysphagia were the most common causes for failure of primary antireflux procedures in this series.

Herniation of the fundoplication followed by partial or total disruption of the fundoplication were the most common causes of persistent or recurrent GERD. Revisional procedures were able to cure GERD is most patients. Adequate mobilization of the esophagus is a cornerstone for creation of a fundoplication not exposed to undue tension.[7,9,34] A misplaced Nissen fundoplication is the result of a technical error in which the fundoplication is incorrectly placed over the stomach. A slipped Nissen fundoplication is due to slippage of the stomach up through an intact wrap.

Dysphagia following laparoscopic fundoplication has been reported from 2.1% to 31%.[32,39] This wide variation may be associated with different methods employed for clinical assessment of this complication and differences of operative technique. It has been suggested that either partial fundoplication or division of the short gastric vessels may reduce postoperative dysphagia.[32,39] Dysphagia was reduced by the routine use of partial fundoplication in one randomized study.[32] However, division of the short gastric vessels did not decrease postoperative dysphagia in two randomized studies.[32,38] Severe dysphagia was the second major cause leading to revisional operation in our series. Tight fundoplication was the most common cause of severe dysphagia.

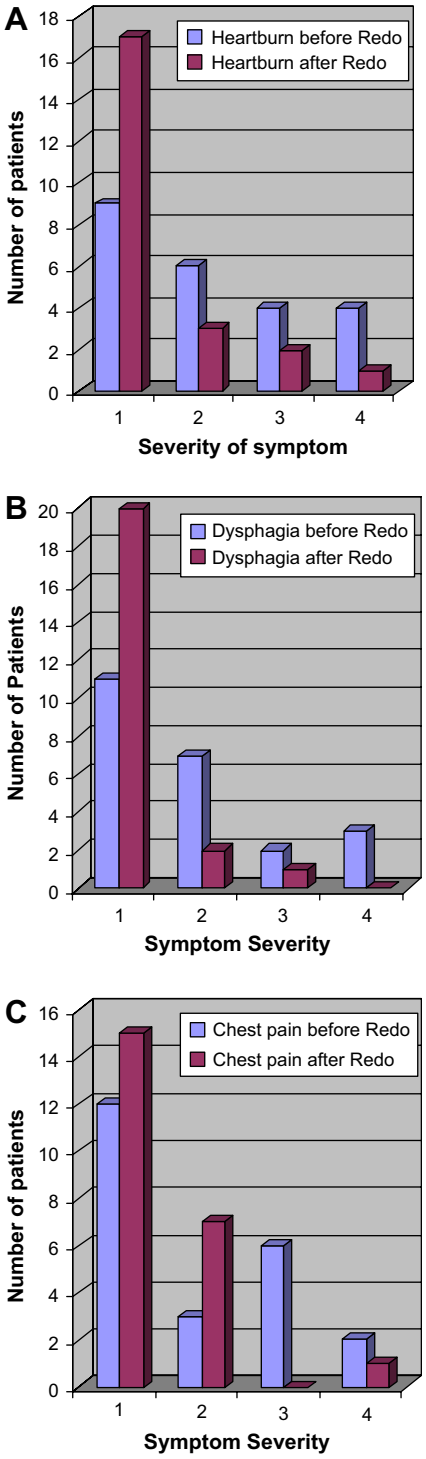

Fig. 6. Symptomatic outcome; A, Heartburn; B, Dysphagia; C, Chest pain. Where 1 = no, 2 = mild, 3 = moderate, 4 = severe (according to symptom severity scale shown in Table 2).

A tight wrap occurs usually because of poor surgical technique. A bougie is considered helpful in preventing postoperative dysphagia, but the use of a bougie results in a higher incidence of esophageal perforations.[31] A bougie was not used in any of our study patients but it caused a perforation in one patient operated in our center in the past. A tight wrap must be taken down and the fundoplication is refashioned either as a floppy or a partial fundoplication. A tight crural repair is usually caused by surgical inexperience. Fibrotic scars at the site of crural repair must also be released to resolve dysphagia.[26]

Table 7
Results of esophageal manometry and 24-pH metry studies before and after secondary surgery.

	Before secondary surgery ($n = 21$)	After secondary surgery ($n = 21$)
Esophageal manometry		
LESP (mmHg)	14.6 ± 7	18.4 ± 6.7
Distal body amplitude (mmHg)	34 ± 8.2	35.3 ± 11.3
24-hour pH metry		
% total reflux time*	4.5 ± 7.8	1.0 ± 1.7
De Meester score*	14.2 ± 24.2	3.4 ± 7.2
For patients with recurrent reflux ($n = 16$)	28.7 ± 15.5	7.9 ± 4.3
Others ($n = 5$)	10.6 ± 5.2	4.1 ± 18.9

*p value is <0.001.

The most appropriate time to reoperate patients with dysphagia following antireflux procedures is controversial.[7,10] Most patients complain of dysphagia following fundoplication, but it is usually mild and temporary. This symptom disappears spontaneously within few months of the operation in most of these patients.[36] Esophageal dilation was performed in patients with severe dysphagia persisted beyond 4 weeks. We indicated revisional operation only in patients with no dysphagia improvement after failure of endoscopic dilation and after at least 3 months of the operation. However, some authors indicate reoperations earlier. Yau et al. referred that laparoscopic reoperation performed at an early stage is easy and associated with minimal morbidity and fast postoperative recovery.[7] On the contrary, if not performed early, the reoperation would be much more difficult at a later stage. With this approach, however, some patients with dysphagia that would improve with time or dilation might be subjected to unnecessary reoperation. Revisional operation for dysphagia usually consisted of either widening of the hiatus or reconstruction of fundoplication in our study.

Differential diagnosis between herniated fundoplication and paraesophageal hernia may be difficult.[33] However, barium esophagogram and operative findings usually establish the diagnosis.[5,40–42]

Reoperation after a failed antireflux procedure is not devoid of complications as reoperations are more difficult than the primary procedure and may be associated with more complications due to adhesions from previous operation that make identification of anatomic planes difficult.[8,11,12] Most series show a mortality rate of approximately 0.5–2% and a morbidity of 15–40%.[12,43] In the present series, most operative complications were minor and there was no mortality.

Several authors have reported that the success rate with revisional operations was inferior to that of primary procedures.[15,31,36–38] Our 0% mortality attests to the safety of these procedures. Revisions of failed fundoplication have been performed traditionally by means of an open operation, but recent studies suggest that laparoscopic approach may be preferred.[35,38,44–49] SARS was completed laparoscopically in only 2 patients in this series which is too small to draw a firm conclusion.

The present study demonstrates that a SARS to correct previous antireflux surgery may be performed safely. The complications did not lead to significant morbidity. The high patient acceptance rate indicates that postoperative symptoms are more tolerable than preoperative symptoms. Careful patient selection and preoperative evaluation are necessary to determine appropriate candidates for reoperation and the correct choice of operation to be performed.

Conflicts of interest
The authors have no conflict of interest.

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Ethical approval
All procedures, including obtaining written informed consent from the patient, were conducted in accordance with the recommendations of the Ethics Committee of the Faculty of Medicine, Mansoura University.

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